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INVESTIGATION OF THE APPLICATION OF
HCMM THERMAL DATA TO SNOW HYDROLOGY

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Type II Report for Period
July through September 1978

Prepared for..

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HCMM-036

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1. INTRODUCTION

1.1 Objectives of Investigation

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The objectives of the investigation of the application of HCMM thermal data to snow hydrology (HCMM Investigation No. 036) are as follows:

- (1) Determine practical utility of HCMM thermal IR data to establish distribution of snow cover and determine accuracy of temperature measurements.
 - a. Determine accuracy of surface temperatures acquired through use of HCMM thermal IR measurements.
 - b. Determine relative resolution utility between VHRR and HCMM for thermal IR measurements.
 - c. Specifically delineate and quantify the problems involved with measuring snow temperature from space and relate them to present and planned earth observing satellite systems. This objective will take into consideration and utilize the capability of HCMM for day and night thermal measurements over appropriate sites and the satellite's eight-day repeat cycle.
- (2) Determine if and how HCMM measurements can be factored in with Landsat data into an overall snow hydrology program related directly to snowmelt runoff prediction.
- (3) Develop an approach to automated data processing of combined visible and thermal infrared satellite acquired data to provide information of interest and use to the snow hydrologist.

1.2 Anticipated Results

The primary anticipated result of the proposed investigation is the development of improved techniques for the mapping and analysis of snow-cover using spacecraft-acquired data. The results will provide an evaluation of the usefulness of high resolution thermal infrared data for snow mapping and for input to snowmelt prediction programs; and will provide a better understanding of the relationships between the measured temperature values and such factors as type of snow, snow depth, type of

terrain, and vegetation. The mapping and analysis techniques can then be applied to the automatic processing of data from future spacecraft systems, and will eventually enable snow survey, which is a vital part of water resources management, to be accomplished on a more cost-effective basis.

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2. ACCOMPLISHMENTS DURING REPORTING PERIOD

During this reporting period we received the first test imagery from the HCMN satellite. Both visible and IR images were received for a daytime flight on 31 May 1978 covering our Sierra Nevada test site. Initial analysis of these data showed that snow covered areas could be readily identified in both the visible and IR displays. As we expected from past experience, the apparent extent of snow cover was less in the IR than in the visible image. This variation in the IR display is largely due to the effects of patchy, melting snow along the edge of the snowpack. We are also currently evaluating the usefulness of photographic enhancement and enlargement techniques using the 9 inch x 9 inch negative transparencies of the satellite imagery. This appears to be a helpful technique, but more work with it will be done over the next few weeks before any conclusions can be reached.

In addition to our work with the satellite imagery, a moderate level of effort has been expended on the continued analysis of four of the U-2 HCMR flights over the Sierra Nevada in the Kings River Basin area. Portions of the following flights were selected for analysis:

Number 33 - Flight 78-067	Daytime	May 31, 1978
Number 34 - Flight 78-068	Pre-dawn	June 1, 1978
Number 35 - Flight 78-098	Daytime	July 19, 1978
Number 36 - Flight 78-099	Pre-dawn	July 20, 1978

The polaroid prints for each of these flights were reviewed so that appropriate sections of the CCT's could be selected for analyses. The criteria for selecting areas for analyses were the presence of snow cover, limited cloud cover, non-snow covered land, and photoidentifiable reference features, i.e. lakes, physiographic features. The areas selected for analyses have allowed us to investigate the diurnal IR temperature variations for identical features imaged on consecutive flights. We are

also analyzing the temperature differences over the 50-day interval between the May-June and July flights. Representative IR temperatures of a lake are as follows:

Lake Edison Temperature Variations

Flight #	Average IR Temperature (°K)
33-day (31 May)	289°
34-night (1 June)	285.5°
35-day (19 July)	294.4°
36-night (20 July)	292°

We have also begun to identify identical areas of known snow cover for the evaluation of IR temperature variations.

3. PROBLEMS

No significant problems are anticipated at this time.

4. PLANS FOR THE NEXT REPORTING PERIOD

It is anticipated that calibrated CCT data from the satellite will be received during the next reporting period. Our efforts will be directed towards working with both the digital satellite data and enhanced photographic products in light of knowledge gained through our evaluation of the U-2 data. Also, a comparison between the satellite data (30 May) and U-2 data (31 May and 1 June) will be initiated.

5. TRAVEL

No travel occurred during the past reporting period.

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6. PUBLICATIONS

No publications have resulted from this investigation.

7. SIGNIFICANT RESULTS

No significant results have been obtained through the fourth reporting period of the investigation.

8. FUNDS EXPENDED

Approximately 25 per cent of the available funds have been expended to date. It is anticipated that the remaining funds will be adequate to complete the project.

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